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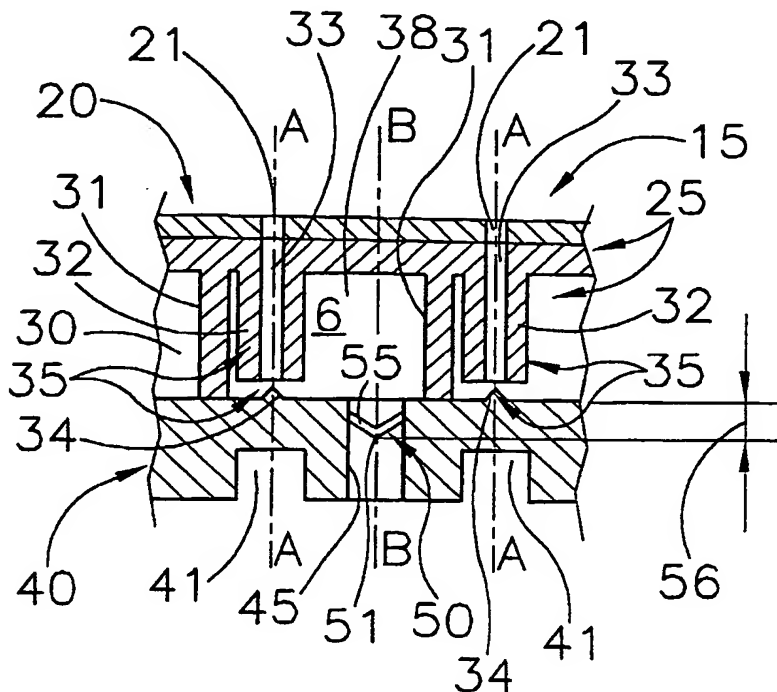
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ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: SHOE, ADJUSTABLE, TRANSPIRING AND CUSHIONING



(57) Abstract: Transpiring and cushioning shoe (10) having a sole (15) comprising an insole (20) through which holes pass, a tread (40) and an elastic intermediate structure (25) having in it a plurality of small chambers (38) placed side by side each communicating, by means of a one-way suction valve (35) through the holes in the insole (20), with the inside of the shoe (10), and by means of an expulsion valve (50) in the tread, with the outside so that with every step taken, due to alternating pressure of the shoe on the ground, air contained in the chambers (38) automatically flows outside and is replaced, in said chambers (38), by air from inside the shoe containing perspiration and heat.

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10 Shoe, adjustable, transpiring and cushioning

Walking is known to require protection of the feet by some form of footwear such as shoes.

Shoes, however, practically enclose the foot in a chamber that retains perspiration and warmth.

15 It often follows that this condition provokes aching, overheating, unpleasant odours, inflammation.

To overcome these drawbacks soles have been devised complete with means providing ventilation between the foot and the shoe, or physical means, such as filtering membranes, or mechanical means.

20 Such means, however, cannot at present provide more ventilation per step than one cm^3 while at least 10 cm^3 per step would be needed.

Since the effort required to obtain this ventilation is made by the weight of the body as the pressing force and lowering of the sole as
25 movement, it follows that the sole must be adequately lowered.

In hot climates and during the stresses set up by sports activity, much better ventilation is obviously required.

The above invention not only makes possible a far greater quantity of air transpired at each step, but also creates a cushioning effect as
30 will now be explained.

Subject of the invention is an adjustable transpiring and cushioning shoe, the sole of which comprises an insole with through holes

forming the bottom of the shoe, a tread with one-way expulsion valves and an intermediate elastic structure containing a plurality of small chambers side by side each of which communicates, by means of a one-way valve here called a suction valve, with the inside of the shoe and by means of an expulsion valve with the outside.

When the foot presses the ground, causing said intermediate structure to yield by compression and flexion, at each step there is automatic closure of said suction valves, compression of the air contained in the chambers and its expulsion outside through the expulsion valves.

When the foot leaves the ground the expulsion valves automatically close and the suction valves automatically open thus transferring the air, mixed with perspiration and heat, from insideinside the shoe into the chambers through said suction valves connected to the holes in the insole.

The chambers are preferably obtained in their full height from the intermediate structure comprising an upper base, thin peripheral and internal ribs, glued onto the tread.

The suction valves are formed of fine tubes in a single piece with the intermediate structure, placed substantially alongside an inner wall of the ribs and open at the top at the position of the holes that pass through the insole.

Placed on the inside surface of the tread, in line with and at a short distance from each of said tubes, are raised cone-shaped protrusions the mean diameter of which corresponds to the inner diameter of said tubes, so that when the foot begins to apply pressure to the ground, and due to elastic flexion of the intermediate structure, the ends of said tubes, making contact with said protrusions, cause said suction valves to close.

In one execution the tubes that form the suction valves can be replaced by ducts made inside the ribs of the intermediate structure.

According to the type of execution, the ribs on the intermediate structure can be inclined or curved to facilitate flexion under pressure from the foot.

5 The expulsion valves are preferably membranes with cross cuts the thickness of which is greater, and their height lesser, the greater is the force programmed for causing them to open.

According to the type of execution the membranes can be discoid, cone-shaped, cap-shaped.

10 Dimensions of the decisive parts of the sole, such as its height, the height of the intermediate elastic structure, rib thickness, volume of the chambers, dimensions and thicknesses of the suction and expulsion valves and therefore the volumes of transpiration air and forces needed to operate said valves, are all pre-set according to the type of shoe and therefore according to what is required to withstand
15 stresses created during sports, military uses, ordinary walking, use by children, for high boots, for orthopaedic purposes.

The invention offers evident advantages.

The quantity of heated air mixed with perspiration removed from the shoe by suction at each step, that can be estimated at between 10
20 and 350 cm^3 , is considerably more than is needed to eliminate the amount of heat and perspiration that forms inside a shoe even under highly stressed conditions.

Elimination of heat from the feet keeps them cool while elimination of perspiration keeps them dry.

25 By suitably calculating the dimensions of the decisive parts of the sole, a cushioning effect can also be calculated.

In conclusion, deambulation, both in highly stressed conditions of effort and heat as well as in ordinary walking, can be undertaken with greatly increased comfort by the wearer of these shoes.

30 Characteristics and purposes of the invention will be made still clearer by the following examples of its execution illustrated by diagrammatically drawn figures.

Fig. 1 The invented shoe, the sole of which comprises an insole, a tread and an intermediate structure, of considerable thickness to withstand stresses, side view.

Fig. 2 Longitudinal section of the sole, through the axis XX.

5 Fig. 3 Enlarged detail of Figure 2.

Fig. 4 Detail of Figure 3 seen from below.

Fig. 5 Insole, perspective seen from below.

Fig. 6 Intermediate structure, perspective seen from below.

Fig. 7 Tread, perspective seen from below.

10 Fig. 8 Walking shoe with thinner sole, side view.

Fig. 9 Enlarged longitudinal section of the shoe sole in Figure 8.

Fig. 10 The detail in Figure 9 seen from below.

The shoe 10 made to withstand high stresses (Figure 1) presents an upper 11 and a sole 15 consisting of the insole 20, tread 40 and elastic structure 25.

Said structure 25 comprises the peripheral ribs 30, a network of transversal ribs 31, valve bodies 32 with cylindrical holes 33 and the small chambers 38 formed by said ribs, open towards the tread 40.

20 The tread 40 comprises externally the transversal channels 41 and, between one channel and another, the cylindrical holes 45 situated substantially in the centre of the chambers 38 of the membrane 30.

Said holes 45 are closed by the conical expulsion valves with membrane 50, with the top 51 facing towards the outside of the tread, and with cross cuts 52 and 53.

25 As the cuts are made in elastic material on the inside of the cone, the edges of the cut close hermetically when external pressure is greater than pressure from inside the shoe.

Inside the tread 40 are the valve heads 34 of the valve bodies 32 in the intermediate structure 25.

30 Said valve heads 34 are cone-shaped and are placed in line with said valve bodies 32, together forming the suction valves 35.

The insole 20 presents, in line with the valve bodies 32, holes 21 diameter of which is the same as that of said valve bodies 32.

The holes 21 in the insole 20 and the holes 33 in the valve bodies 32 and in the valve heads 34 present the same geometrical axis (shown
5 as AA in Figures 2 and 3).

This axis lies substantially in the centre of each transversal channel 41 of the tread 40.

The holes 45 in the tread for conical membrane expulsion valves 50, crossed by axes BB in Figures 2 and 3, are situated substantially in
10 the centre of the chambers 38 in the intermediate structure 25 and therefore between one channel 41 and another.

Both the intermediate structure 25 and the tread 40 are respectively made in a single piece of suitably elastic plastic material.

It will be clear from the foregoing that when, during deambulation, the
15 shoe 10 worn by the person rests on the ground, this will cause compression and deformation of the ribs 30 and 31 and also of the valve bodies 32.

Matching between the ends of the valve bodies 32 and valve heads 34, and therefore closure of the valves 35 formed by these parts,
20 consequently causes the air 6 in the chambers 38 to flow out through the cone-shaped valves 50 in the tread 40 (Figure 3).

When the foot leaves the ground, the ribs 30 and 31, the valve bodies 33 and the cone-shaped valves 50 tend to resume their original shape, namely opening of the valves 35 and closure of the
25 valves 50, so creating a depression inside the chambers 38, and therefore suction through the valve bodies 33 and holes 21 in the insole 20, of heated air containing perspiration from inside the shoe 10.

It follows that, at each step, there will be high degree of ventilation
30 from the shoes with a flow of air far greater than can be obtained with present footwear, as well as an efficacious cushioning effect.

The ventilating and cushioning effect can be adjusted by applying suitable dimensions to the chambers, to the intermediate structure 25, to thickness of the peripheral ribs and those inside the valves 35 and 50, and therefore volume and capacity of ventilating air.

5 Figure 8 shows a walking shoe 60 with an upper 61 and sole 65.

The sole 65 is substantially the same as the sole 15 for the shoe 10 but dimensions are smaller.

Said sole 65 presents an insole 70, intermediate structure 75 and tread 85.

10 The insole 70 presents holes 71.

The intermediate structure 75 presents ribs 76, chambers 80 and valve bodies 77 with cylindrical holes 78.

The tread 85 presents cone-shaped membrane valves 90 for expulsion with orthogonal cuts 92, 93 in the holes 86.

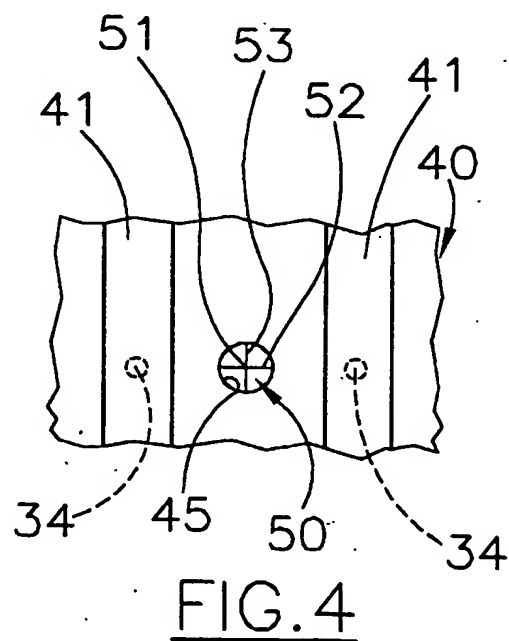
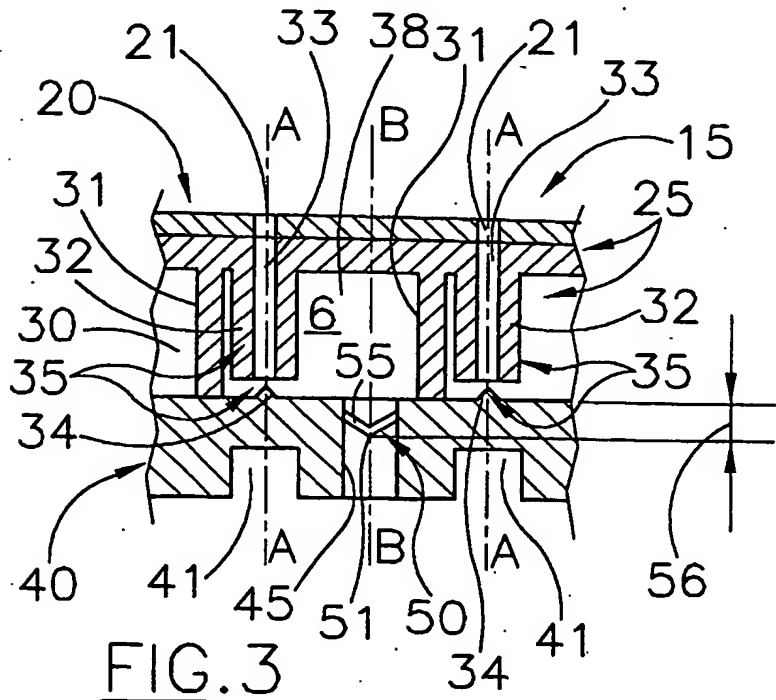
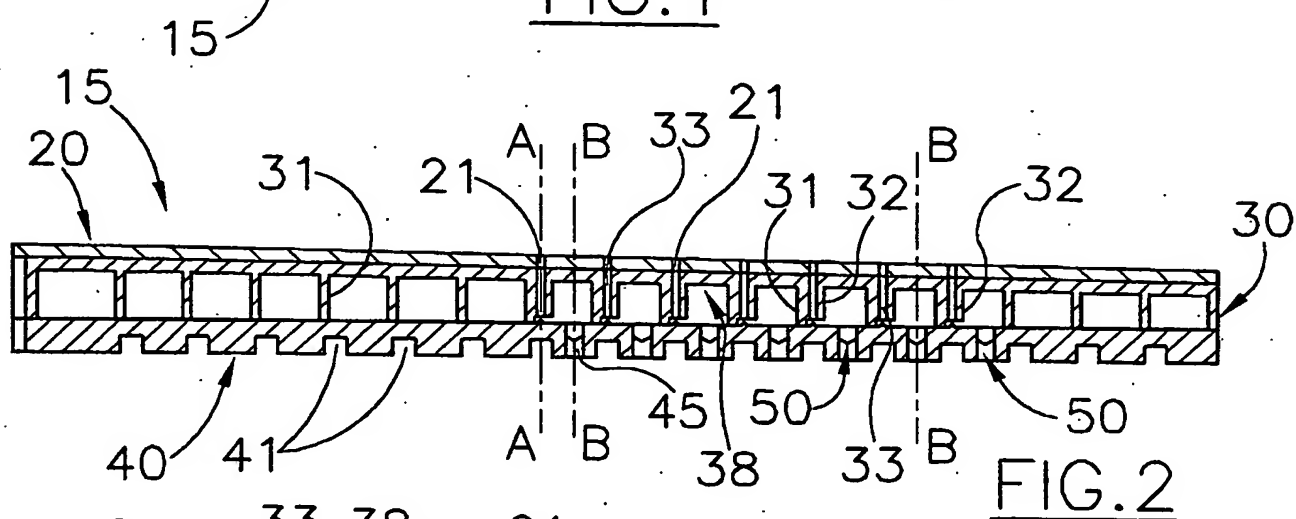
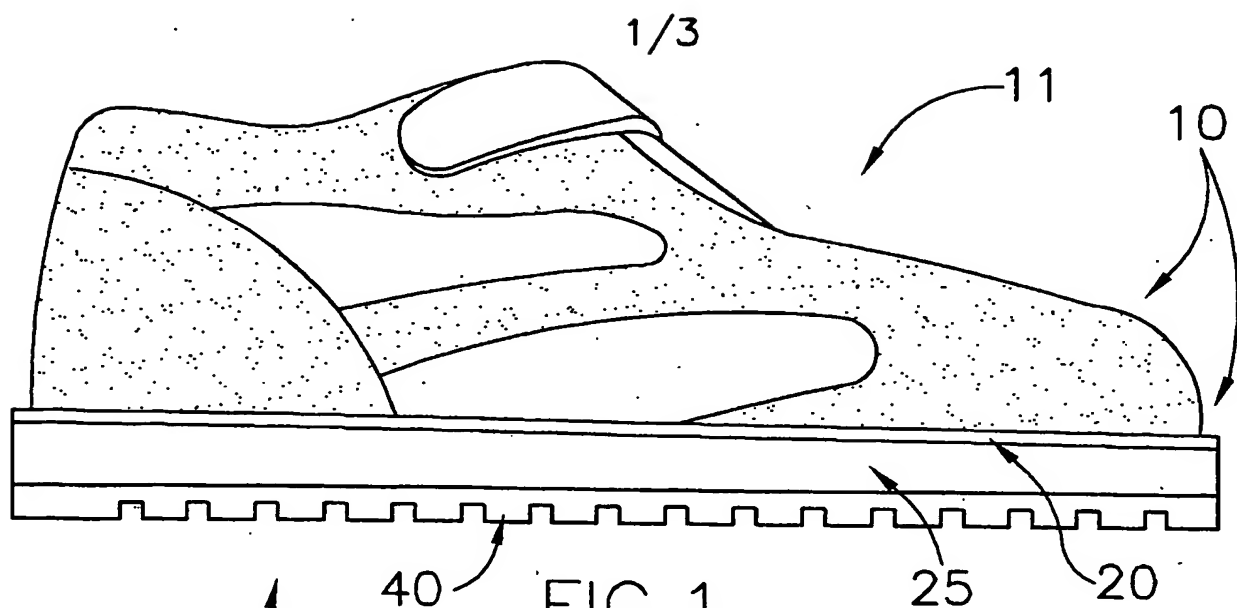
15 Said valves are thinner 95 and higher 96 than the membrane valves 50 in the tread 40 of the shoe 10.

As said valves 90 in the shoe 60 open at the slightest pressure into the chambers 80, these are of the type best suited for ordinary walking, for children, for rubber boots and the like.

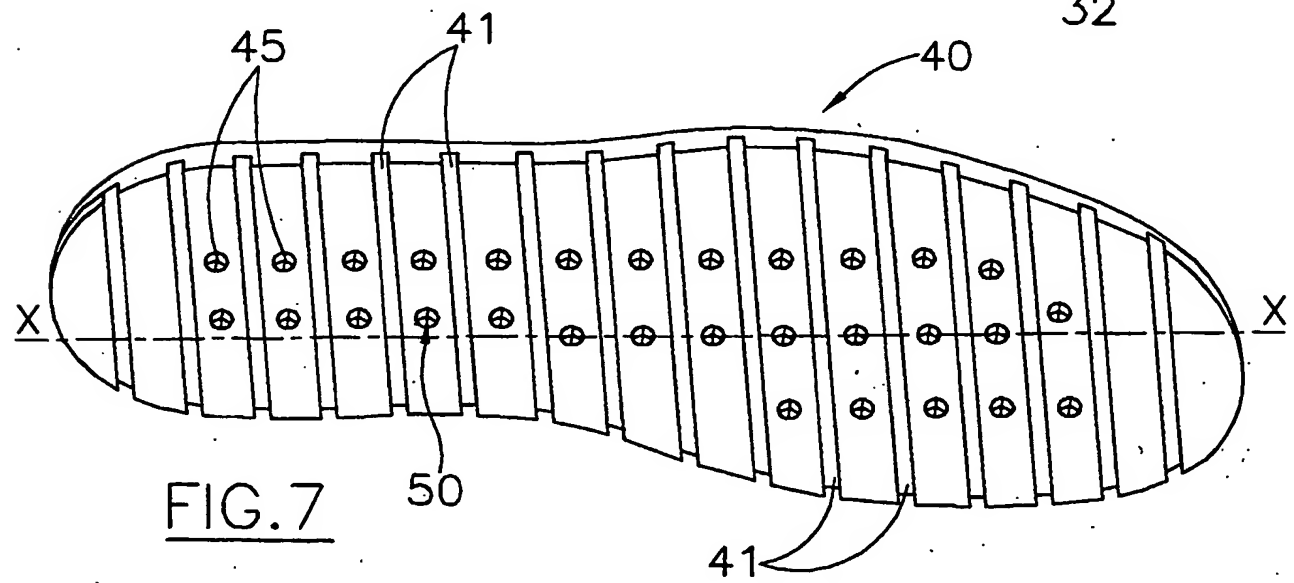
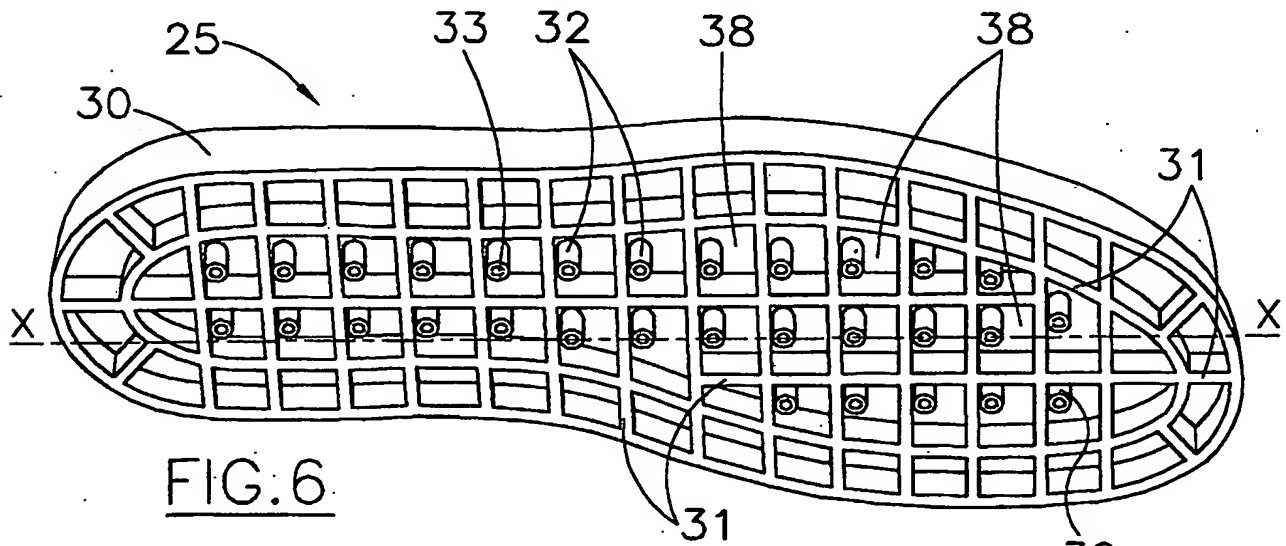
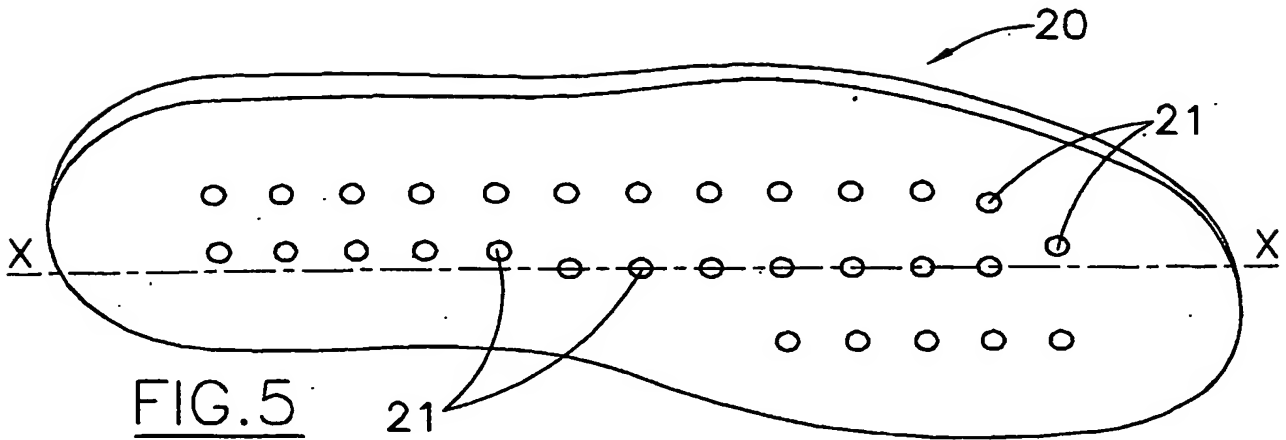
CLAIMS

1. Shoe, adjustable, transpiring, cushioning
characterized in that the sole comprises an insole with through holes
constituting the bottom of the shoe, a tread with one-way expulsion
valves and an elastic intermediate structure with a plurality of small
5 chambers placed side by side, each of which communicates, through
a one-way valve, here called a suction valve, with the inside of the
shoe and by means of an expulsion valve in the tread communicating
with the outside, and in that at each step, when the foot presses on
10 the ground with consequent yielding due to compression and flexion
of said intermediate structure, automatic closure takes place of said
suction valve and compression of the air contained in the chambers
and therefore its transfer outside through the expulsion valves while,
when the foot is raised from the ground, automatic closure takes
15 place of the expulsion valves and opening of the suction valves with
transfer inside the chambers through said suction valves, connected
to the holes in the insole, of the air contained in the shoe mixed with
perspiration and heat.
2. Shoe as in claim 1,
20 characterized in that the chambers are formed at their full height from
the intermediate structure, comprising an upper base, peripheral
ribbing and a network of internal ribs, glued onto the tread.
3. Shoe as in claim 2,
characterized in that the peripheral and internal ribs are thin.
- 25 4. Shoe as in claim 2,
characterized in that the internal ribbing is inclined in order to
facilitate flexion under pressure created by the foot.
5. Shoe as in claim 2,
characterized in that the internal ribbing is curved in order to facilitate
30 flexion under pressure created by the foot.
6. Shoe as in claims 1 and 2,

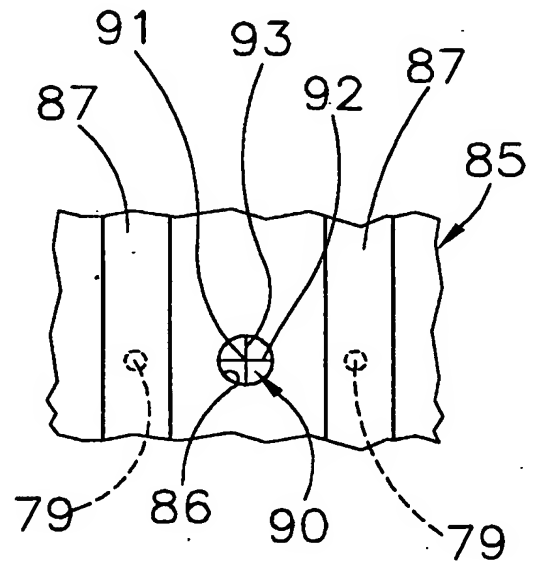
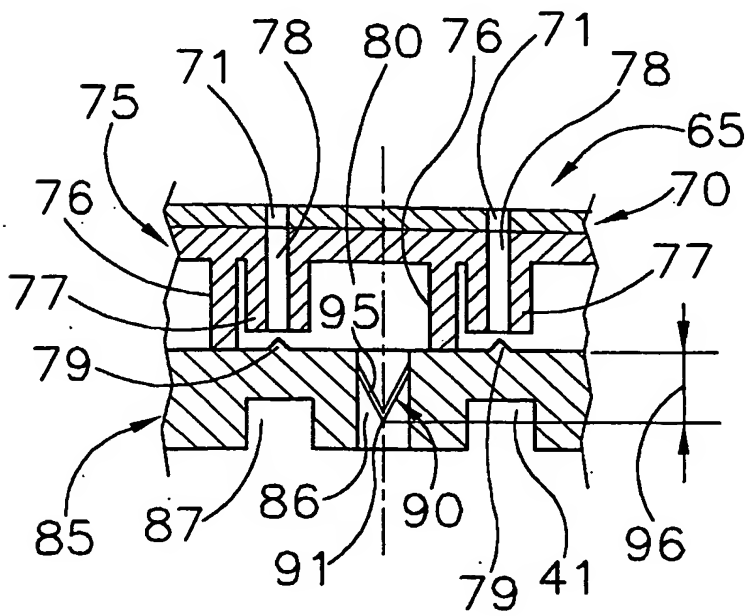
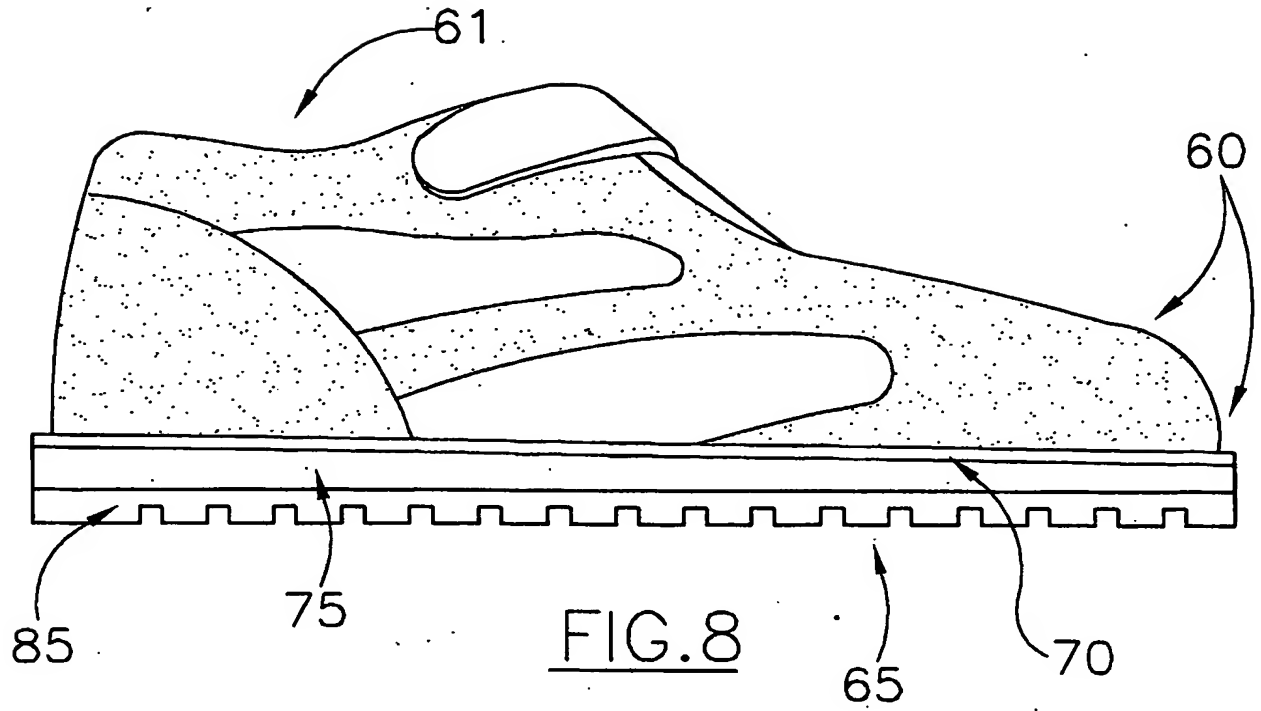
- characterized in that the suction valves are formed of small tubes, in a single piece with the intermediate structure, substantially laid along an internal wall of the ribbing and open above at the position of the holes that pass through the insole, there being on the internal surface
- 5 of the tread, in line with and at a short distance from each of said tubes, cone-shaped protrusions with a mean diameter corresponding to the internal diameter of said tubes, so that when the foot begins to press on the ground, and due to elastic flexion of the intermediate structure, the ends of said tubes make contact with said cone-shaped
- 10 protrusions causing said suction valves to close.
7. Shoe as in claim 6,
- characterized in that the tubes of the suction valves are replaced by ducts created inside the ribs on the intermediate structure.
8. Shoe as in claim 1,
- 15 characterized in that the expulsion valves are membranes with cross-wise cuts, their thickness being the greater and their height the lesser according to the degree of force programmed for opening them.
9. Shoe as in claim 8,
- characterized in that the membranes are discoid.
- 20 10. Shoe as in claim 8,
- characterized in that the membranes are cone-shaped.
11. Shoe as in claim 8,
- characterized in that the membranes are cap-shaped.
12. Shoe as in claim 1,
- 25 characterized in that dimensions of decisive parts of the sole such as its height, the height of the intermediate elastic structure, volume of the chambers, dimensions and thickness of suction and expulsion valves and therefore volume of transpiration air and forces required to operate the valves, are pre-set according to the type of shoe and
- 30 therefore according to cases involving high levels of stress in sports, in military use, or in ordinary walking, for children, for tall boots, for orthopaedic purposes.



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 910 964 A (NOTTINGTON HOLDING BV) 28 April 1999 (1999-04-28) column 3 -column 4; claims; figures 2,3	1-12
A	US 6 282 813 B1 (SQUADRONI ONIFARES ELPIDIO) 4 September 2001 (2001-09-04) column 2, line 55 -column 4, line 6; figures	1,8-11
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A	GB 2 240 254 A (COOK IAN DEREK) 31 July 1991 (1991-07-31) claims 1,6; figures	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>SU 1 077 613 A (URALSKY POLITEKHN INST) 7 March 1984 (1984-03-07) figure</p> <p>-----</p>	

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